



# Wyoming Select Committee on Capital Financing & Investments Reserve Fund Modeling September 28, 2022



# Reserve Fund Modeling

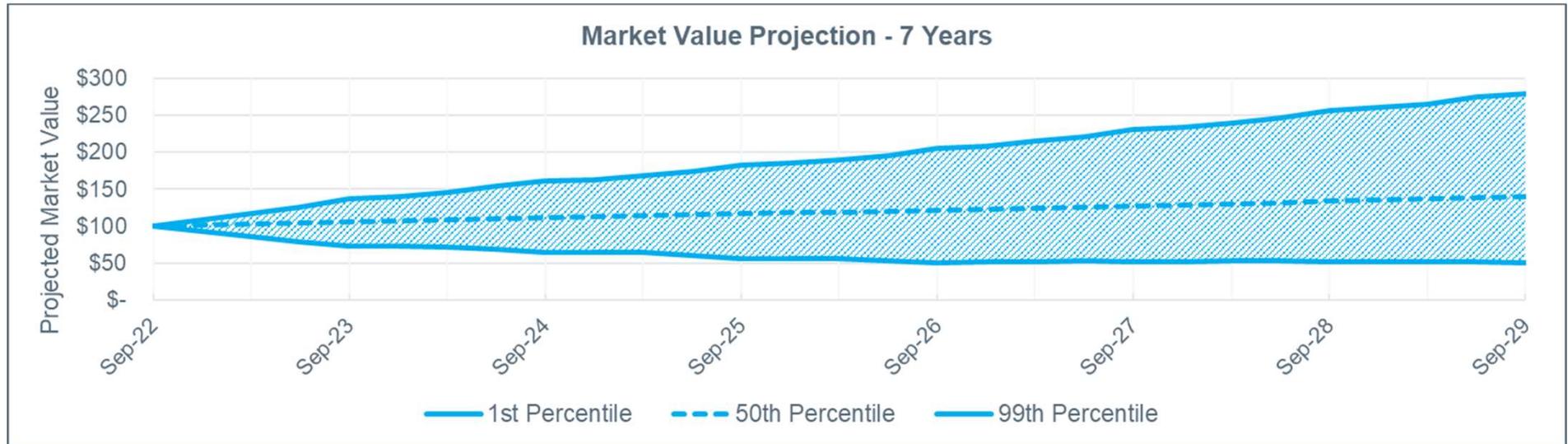
- RVK was asked to prepare an analysis of two different reserve fund levels (5x and 7x)
- For purposes of this analysis, we have assumed the following:
  - All Permanent Funds (excluding Workers Compensation) adopt the asset allocation policy currently in place for the Long-Term Total Return Permanent Funds
  - All existing spending policies remain in place
    - All income is distributed
    - Only net cumulative capital gains are distributed
  - Reserve fund sizes are increased to provide a larger source of potential funding in years when portfolio income falls short of the spending policy amount (SPA)
  - Larger reserve portfolios allow for higher risk asset allocation of reserve funds with higher expected long-term returns
  - Reserve funds are separate from the corpus and each fund has a separate reserve
  - Reserve assets should remain in liquid assets only as they may be needed to fund the spending policy amount
  - In this study we used two scenarios for illustrative purposes - 70/30 and 50/50 (global equities / fixed income)
    - These are for illustrative purposes only, and intended to illustrate potential risk levels. RVK recommends formal asset allocation studies be conducted for any new reserve funds once all parameters are known

# Reserve Fund Modeling

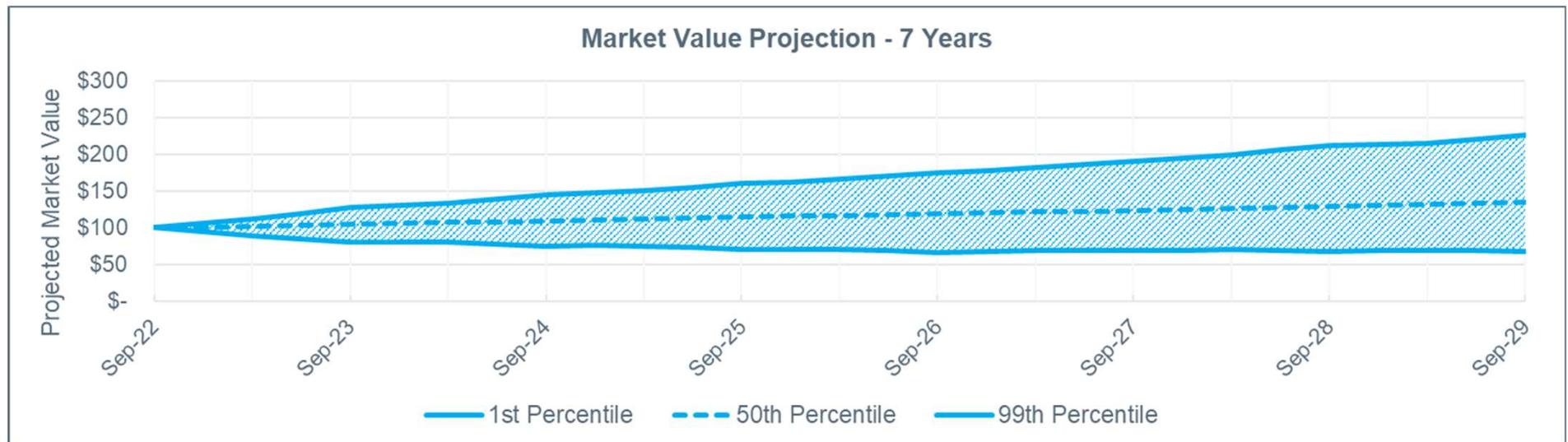
- In order to evaluate the adequacy of 5x and 7x reserve fund levels we combine the following:
  - Stochastic modeling of potential investment outcomes
  - A range of scenarios for draws from the reserve funds
- Additional notes and assumptions:
  - 5x (or 7x) means 5 (or 7) times the potential draw needed in year 1 to fulfill the SPA after accounting for an assumed minimum level of natural portfolio income (estimated at 2%)
  - For simplicity – we assume that 1 year of potential need starts at \$20 and grows at the rate of inflation
    - 5 x reserve fund starting balance = \$100
    - 7 x reserve fund starting balance = \$140
  - No additional contributions are made to the reserves and excess reserves flow back to corpus when they exceed an additional 2 years in reserve (7x and 9x)
  - Reserves are not available for appropriation

# Stochastic Investment Outcomes (no cash flows)

- 70% Global Equity / 30% US Aggregate Fixed Income

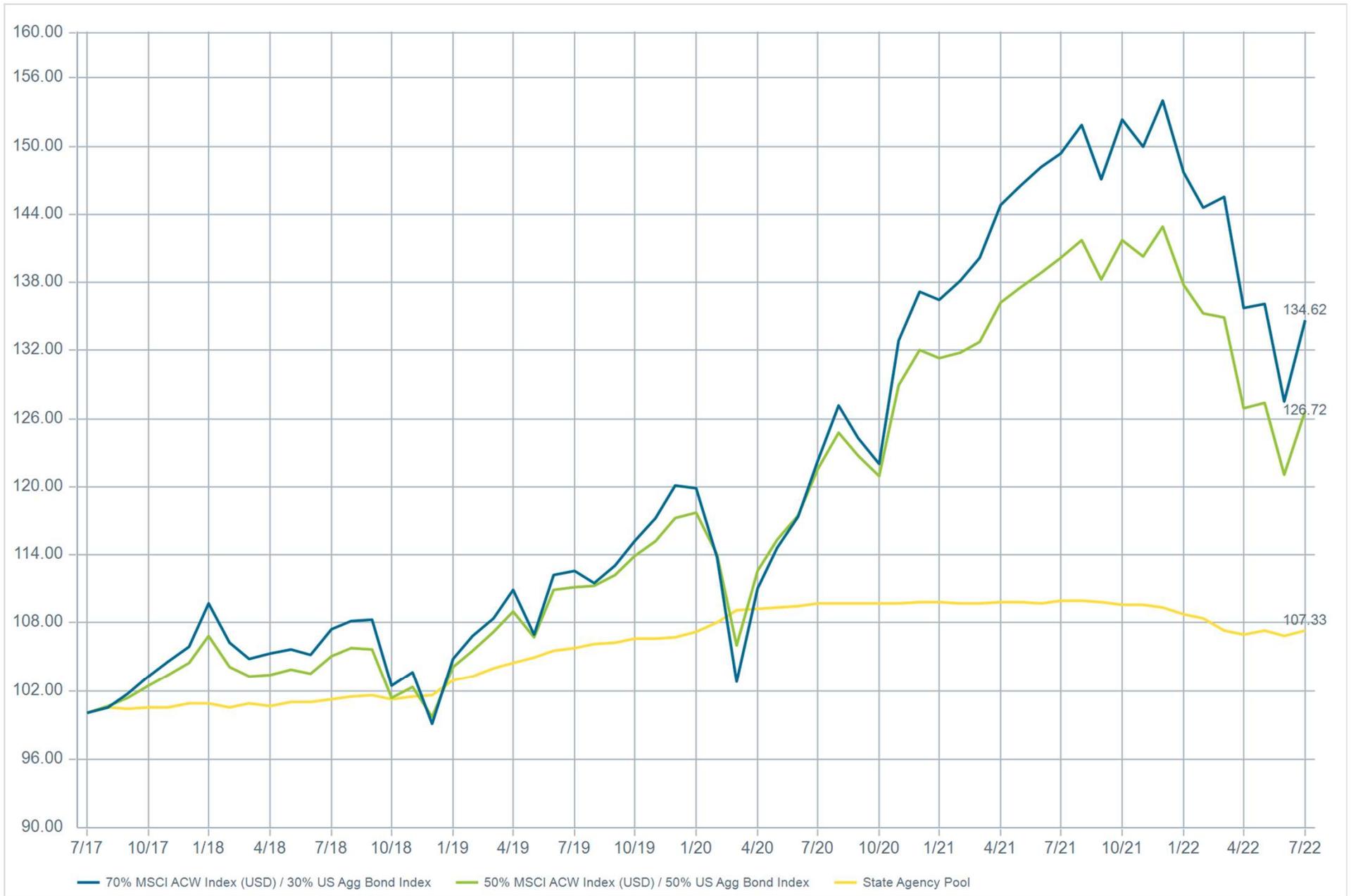


- 50% Global Equity / 50% US Aggregate Fixed Income



Assumes no cash flows or max market value constraint.

# Growth of \$100 – 5 Years Ending July 31, 2022



As of July 31, 2022. Calculation is based on monthly periodicity. State Agency Pool returns are gross of fees.

# Distribution Scenarios – Adjusted for inflation

	Scenario 1	Scenario 2	Scenario 3
Year 1:	\$20.50	\$20.50	\$5.13
Year 2:	\$21.01	\$5.25	\$5.25
Year 3:	\$21.54	\$0.00	\$5.38
Year 4:	\$5.52	\$22.08	\$5.52
Year 5:	\$5.66	\$5.66	\$5.66
Year 6:	\$0.00	\$0.00	\$5.80
Year 7:	\$0.00	\$23.77	\$5.94

- 5X Spending Scenarios

- Assume a starting market value of \$100
- Balance over 7X spending amount is distributed out at the start of the next quarter

- 7X Spending Scenarios

- Assume a starting market value of \$140
- Balance over 9X spending amount is distributed out at the start of the next quarter

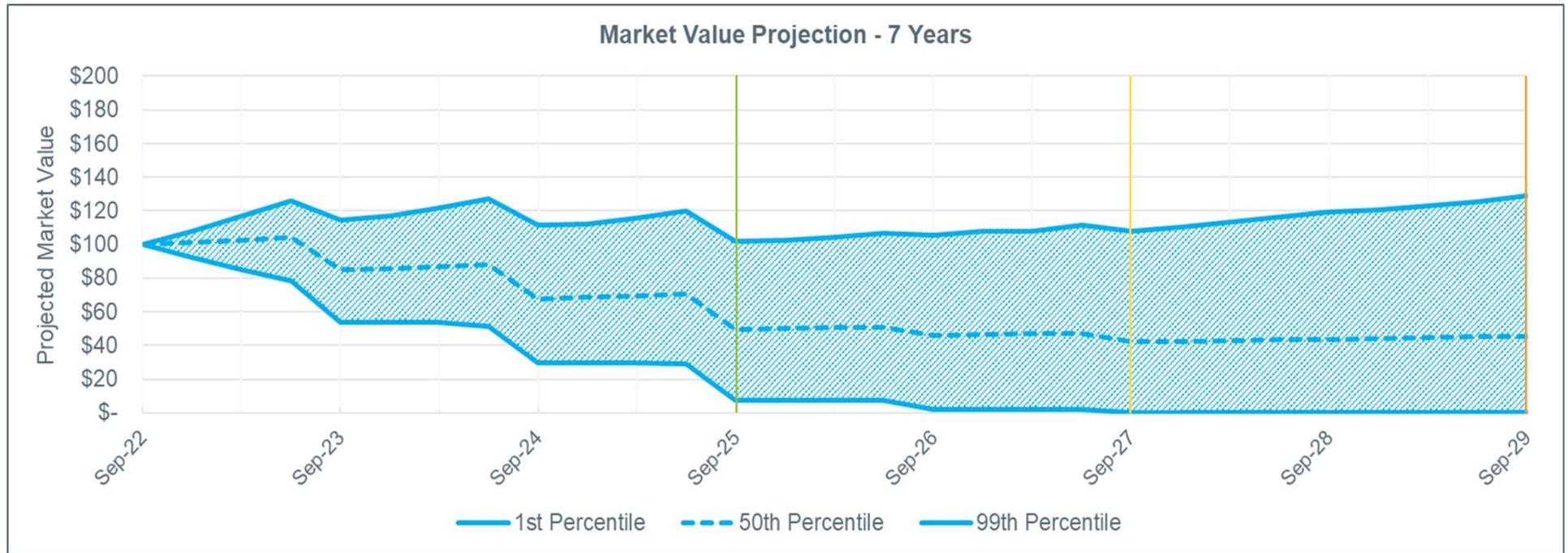
# Scenario 1



# Scenario 1 - Market Values

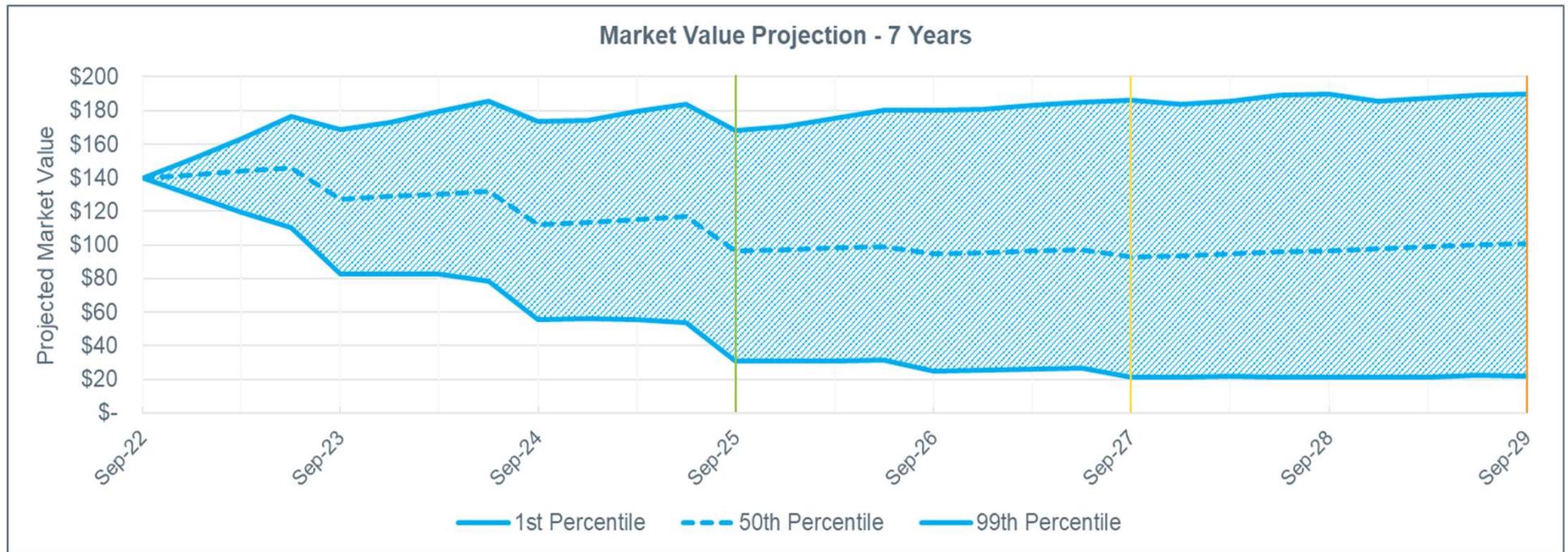
3 Years	5X Spending		7X Spending	
	70/30	50/50	70/30	50/50
1 <sup>st</sup> percentile return	\$ 7.31	\$ 15.77	\$ 30.64	\$ 44.16
5 <sup>th</sup> percentile return	\$ 19.71	\$ 25.47	\$ 50.43	\$ 59.69
10 <sup>th</sup> percentile return	\$ 26.46	\$ 30.52	\$ 61.02	\$ 67.45
25 <sup>th</sup> percentile return	\$ 36.52	\$ 38.43	\$ 76.74	\$ 79.65
50 <sup>th</sup> percentile return	\$ 49.73	\$ 47.72	\$ 96.53	\$ 93.47
75 <sup>th</sup> percentile return	\$ 62.27	\$ 56.87	\$ 115.41	\$ 107.32
90 <sup>th</sup> percentile return	\$ 75.25	\$ 66.03	\$ 135.05	\$ 120.72
95 <sup>th</sup> percentile return	\$ 84.48	\$ 71.89	\$ 148.59	\$ 130.03
99 <sup>th</sup> percentile return	\$ 101.90	\$ 83.53	\$ 168.26	\$ 147.28
5 Years				
1 <sup>st</sup> percentile return	Insolvent Sept 2027	\$ 5.52	\$ 21.30	\$ 35.66
5 <sup>th</sup> percentile return	\$ 8.56	\$ 15.18	\$ 38.88	\$ 49.34
10 <sup>th</sup> percentile return	\$ 15.56	\$ 20.16	\$ 49.57	\$ 57.57
25 <sup>th</sup> percentile return	\$ 27.30	\$ 29.33	\$ 69.23	\$ 72.44
50 <sup>th</sup> percentile return	\$ 42.15	\$ 39.98	\$ 92.74	\$ 89.31
75 <sup>th</sup> percentile return	\$ 57.77	\$ 50.93	\$ 118.25	\$ 107.01
90 <sup>th</sup> percentile return	\$ 74.83	\$ 62.81	\$ 144.83	\$ 125.82
95 <sup>th</sup> percentile return	\$ 86.69	\$ 69.89	\$ 163.33	\$ 137.15
99 <sup>th</sup> percentile return	\$ 108.10	\$ 82.85	\$ 185.94	\$ 157.65
7 Years				
1 <sup>st</sup> percentile return	Insolvent Sept 2027	\$ 6.23	\$ 21.97	\$ 35.24
5 <sup>th</sup> percentile return	\$ 9.14	\$ 15.78	\$ 39.59	\$ 51.05
10 <sup>th</sup> percentile return	\$ 16.34	\$ 21.33	\$ 51.72	\$ 60.34
25 <sup>th</sup> percentile return	\$ 29.09	\$ 31.30	\$ 73.39	\$ 76.58
50 <sup>th</sup> percentile return	\$ 45.56	\$ 42.93	\$ 100.88	\$ 96.86
75 <sup>th</sup> percentile return	\$ 64.65	\$ 56.53	\$ 133.62	\$ 118.85
90 <sup>th</sup> percentile return	\$ 85.62	\$ 69.77	\$ 166.91	\$ 141.91
95 <sup>th</sup> percentile return	\$ 100.99	\$ 79.51	\$ 181.81	\$ 156.74
99 <sup>th</sup> percentile return	\$ 129.28	\$ 96.38	\$ 189.82	\$ 182.03

# 70/30 - 5X Spending Scenario 1



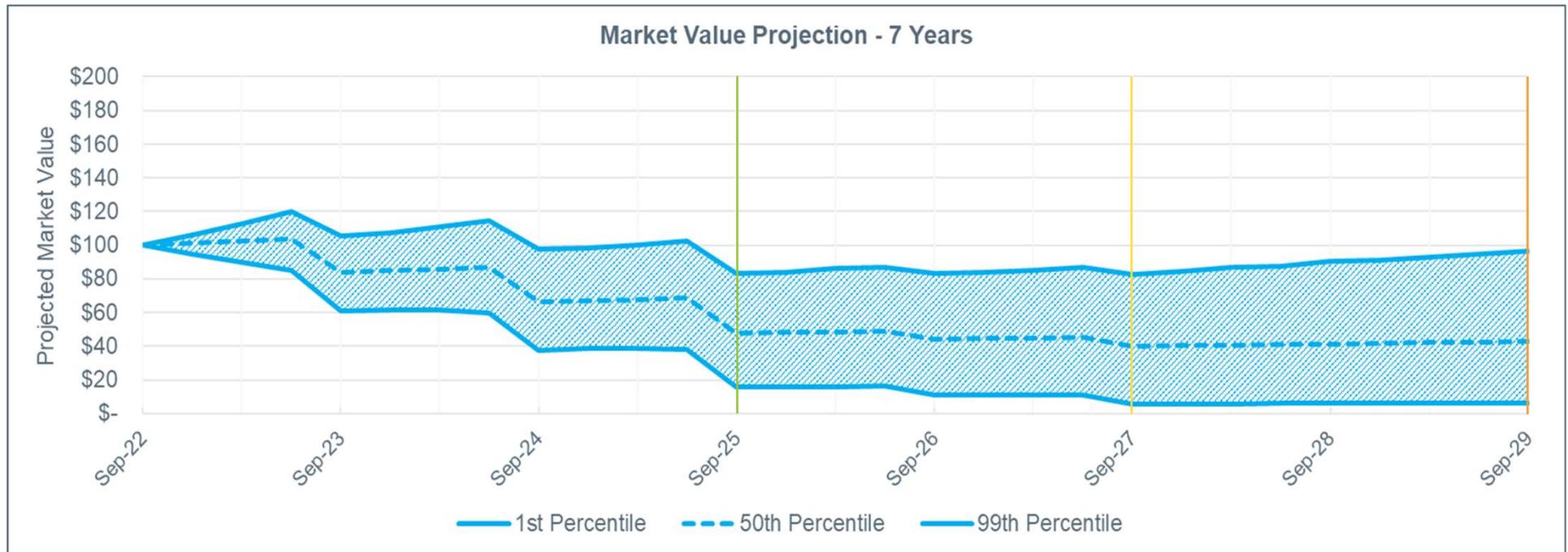
	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	7.31	Insolvent Sept 2027			
5 <sup>th</sup> percentile return	\$	19.71	\$	8.56	\$	9.14
10 <sup>th</sup> percentile return	\$	26.46	\$	15.56	\$	16.34
25 <sup>th</sup> percentile return	\$	36.52	\$	27.30	\$	29.09
50 <sup>th</sup> percentile return	\$	49.73	\$	42.15	\$	45.56
75 <sup>th</sup> percentile return	\$	62.27	\$	57.77	\$	64.65
90 <sup>th</sup> percentile return	\$	75.25	\$	74.83	\$	85.62
95 <sup>th</sup> percentile return	\$	84.48	\$	86.69	\$	100.99
99 <sup>th</sup> percentile return	\$	101.90	\$	108.10	\$	129.28

# 70/30 - 7X Spending Scenario 1



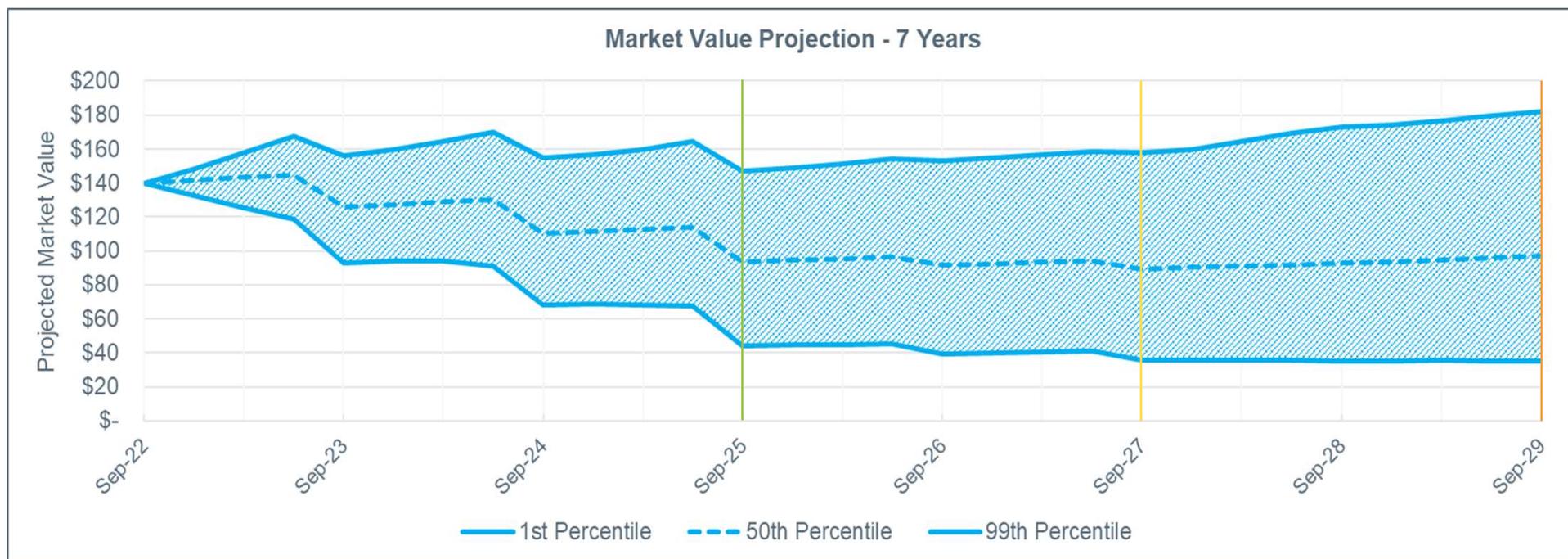
	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	30.64	\$	21.30	\$	21.97
5 <sup>th</sup> percentile return	\$	50.43	\$	38.88	\$	39.59
10 <sup>th</sup> percentile return	\$	61.02	\$	49.57	\$	51.72
25 <sup>th</sup> percentile return	\$	76.74	\$	69.23	\$	73.39
50 <sup>th</sup> percentile return	\$	96.53	\$	92.74	\$	100.88
75 <sup>th</sup> percentile return	\$	115.41	\$	118.25	\$	133.62
90 <sup>th</sup> percentile return	\$	135.05	\$	144.83	\$	166.91
95 <sup>th</sup> percentile return	\$	148.59	\$	163.33	\$	181.81
99 <sup>th</sup> percentile return	\$	168.26	\$	185.94	\$	189.82

# 50/50 - 5X Spending Scenario 1



	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	15.77	\$	5.52	\$	6.23
5 <sup>th</sup> percentile return	\$	25.47	\$	15.18	\$	15.78
10 <sup>th</sup> percentile return	\$	30.52	\$	20.16	\$	21.33
25 <sup>th</sup> percentile return	\$	38.43	\$	29.33	\$	31.30
50 <sup>th</sup> percentile return	\$	47.72	\$	39.98	\$	42.93
75 <sup>th</sup> percentile return	\$	56.87	\$	50.93	\$	56.53
90 <sup>th</sup> percentile return	\$	66.03	\$	62.81	\$	69.77
95 <sup>th</sup> percentile return	\$	71.89	\$	69.89	\$	79.51
99 <sup>th</sup> percentile return	\$	83.53	\$	82.85	\$	96.38

# 50/50 - 7X Spending Scenario 1



	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	44.16	\$	35.66	\$	35.24
5 <sup>th</sup> percentile return	\$	59.69	\$	49.34	\$	51.05
10 <sup>th</sup> percentile return	\$	67.45	\$	57.57	\$	60.34
25 <sup>th</sup> percentile return	\$	79.65	\$	72.44	\$	76.58
50 <sup>th</sup> percentile return	\$	93.47	\$	89.31	\$	96.86
75 <sup>th</sup> percentile return	\$	107.32	\$	107.01	\$	118.85
90 <sup>th</sup> percentile return	\$	120.72	\$	125.82	\$	141.91
95 <sup>th</sup> percentile return	\$	130.03	\$	137.15	\$	156.74
99 <sup>th</sup> percentile return	\$	147.28	\$	157.65	\$	182.03

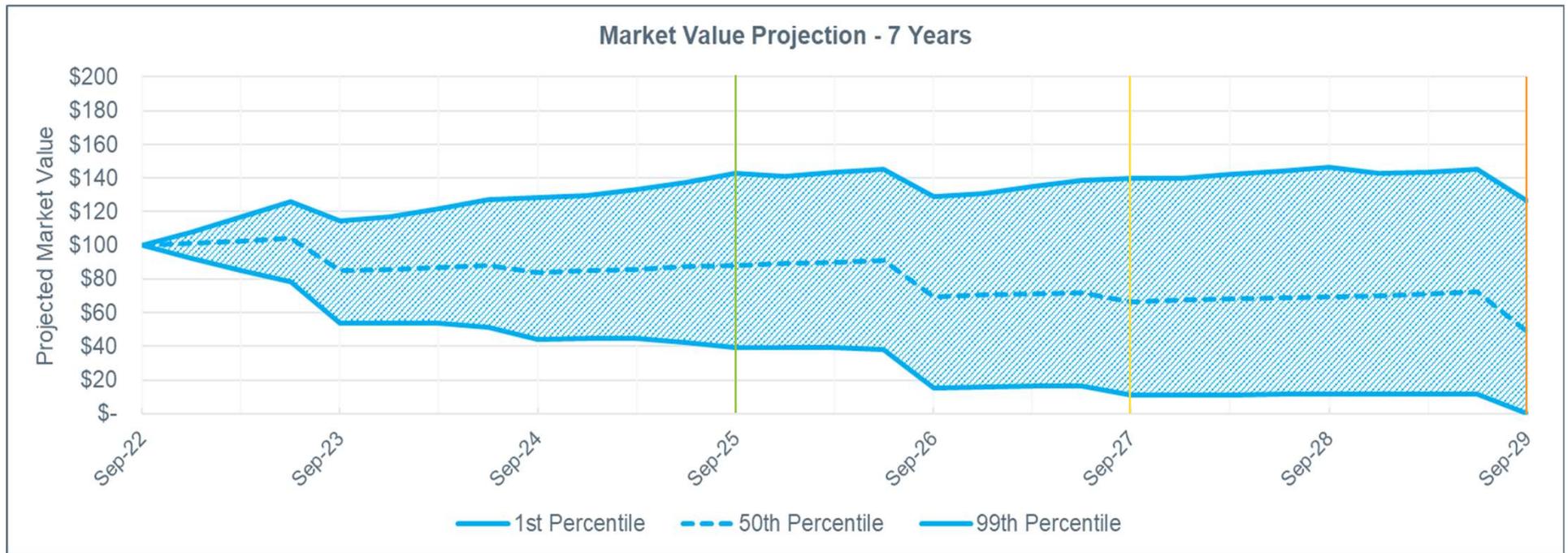
# Scenario 2



# Scenario 2 - Market Values

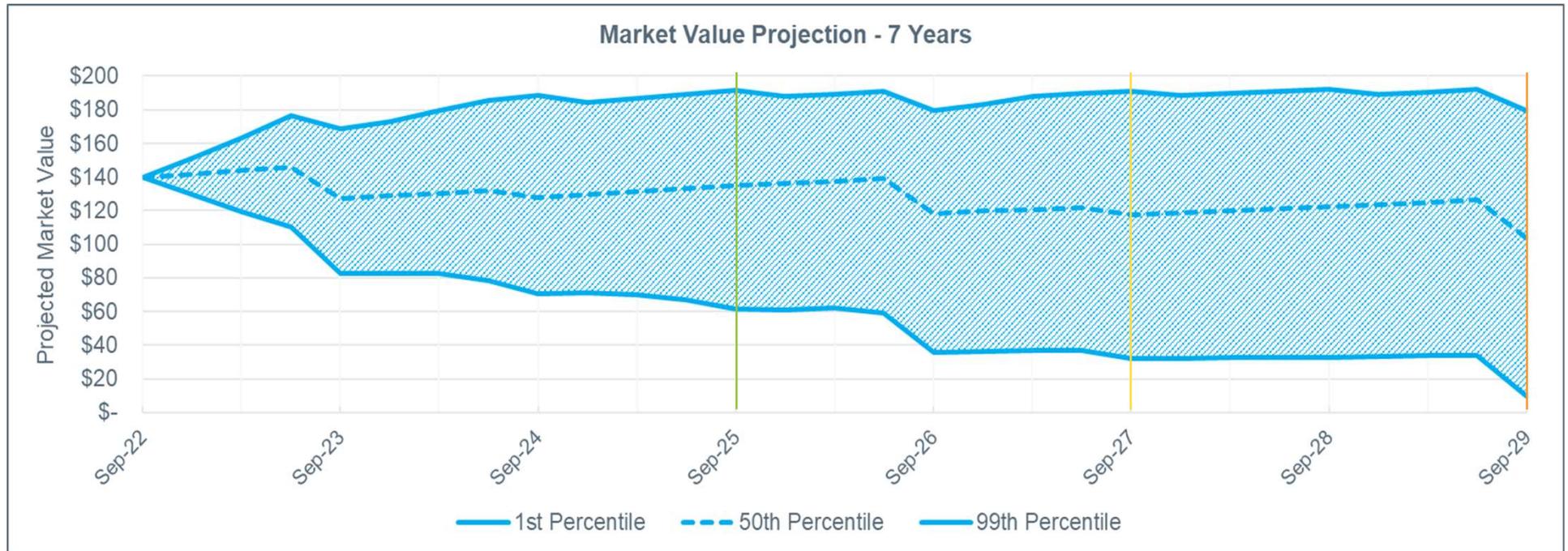
3 Years	5X Spending		7X Spending	
	70/30	50/50	70/30	50/50
1 <sup>st</sup> percentile return	\$ 39.16	\$ 50.21	\$ 61.48	\$ 78.02
5 <sup>th</sup> percentile return	\$ 55.29	\$ 61.81	\$ 85.98	\$ 95.60
10 <sup>th</sup> percentile return	\$ 62.80	\$ 67.45	\$ 97.30	\$ 104.15
25 <sup>th</sup> percentile return	\$ 74.39	\$ 76.31	\$ 114.50	\$ 117.38
50 <sup>th</sup> percentile return	\$ 88.33	\$ 86.20	\$ 135.13	\$ 131.92
75 <sup>th</sup> percentile return	\$ 101.97	\$ 96.10	\$ 155.29	\$ 146.62
90 <sup>th</sup> percentile return	\$ 116.01	\$ 105.92	\$ 175.26	\$ 160.92
95 <sup>th</sup> percentile return	\$ 125.62	\$ 112.45	\$ 184.44	\$ 170.65
99 <sup>th</sup> percentile return	\$ 142.74	\$ 124.52	\$ 191.80	\$ 185.02
<b>5 Years</b>				
1 <sup>st</sup> percentile return	\$ 10.79	\$ 22.63	\$ 31.83	\$ 50.92
5 <sup>th</sup> percentile return	\$ 26.56	\$ 33.96	\$ 56.24	\$ 67.42
10 <sup>th</sup> percentile return	\$ 34.91	\$ 40.47	\$ 68.96	\$ 77.49
25 <sup>th</sup> percentile return	\$ 49.48	\$ 51.60	\$ 91.49	\$ 94.49
50 <sup>th</sup> percentile return	\$ 66.60	\$ 64.02	\$ 117.49	\$ 113.45
75 <sup>th</sup> percentile return	\$ 85.79	\$ 77.50	\$ 145.16	\$ 133.92
90 <sup>th</sup> percentile return	\$ 105.53	\$ 90.87	\$ 168.89	\$ 153.56
95 <sup>th</sup> percentile return	\$ 117.59	\$ 99.52	\$ 181.86	\$ 164.73
99 <sup>th</sup> percentile return	\$ 139.59	\$ 114.95	\$ 190.83	\$ 184.04
<b>7 Years</b>				
1 <sup>st</sup> percentile return	Insolvent Sept 2029	\$ 0.62	\$ 10.06	\$ 27.50
5 <sup>th</sup> percentile return	\$ 3.33	\$ 12.07	\$ 33.37	\$ 46.15
10 <sup>th</sup> percentile return	\$ 12.84	\$ 18.45	\$ 47.80	\$ 56.84
25 <sup>th</sup> percentile return	\$ 28.13	\$ 30.36	\$ 71.92	\$ 75.42
50 <sup>th</sup> percentile return	\$ 48.78	\$ 45.49	\$ 103.92	\$ 98.99
75 <sup>th</sup> percentile return	\$ 72.55	\$ 61.59	\$ 137.35	\$ 124.16
90 <sup>th</sup> percentile return	\$ 97.29	\$ 78.68	\$ 161.04	\$ 148.75
95 <sup>th</sup> percentile return	\$ 111.93	\$ 88.79	\$ 168.45	\$ 159.43
99 <sup>th</sup> percentile return	\$ 126.82	\$ 109.41	\$ 179.53	\$ 170.35

# 70/30 - 5X Spending Scenario 2



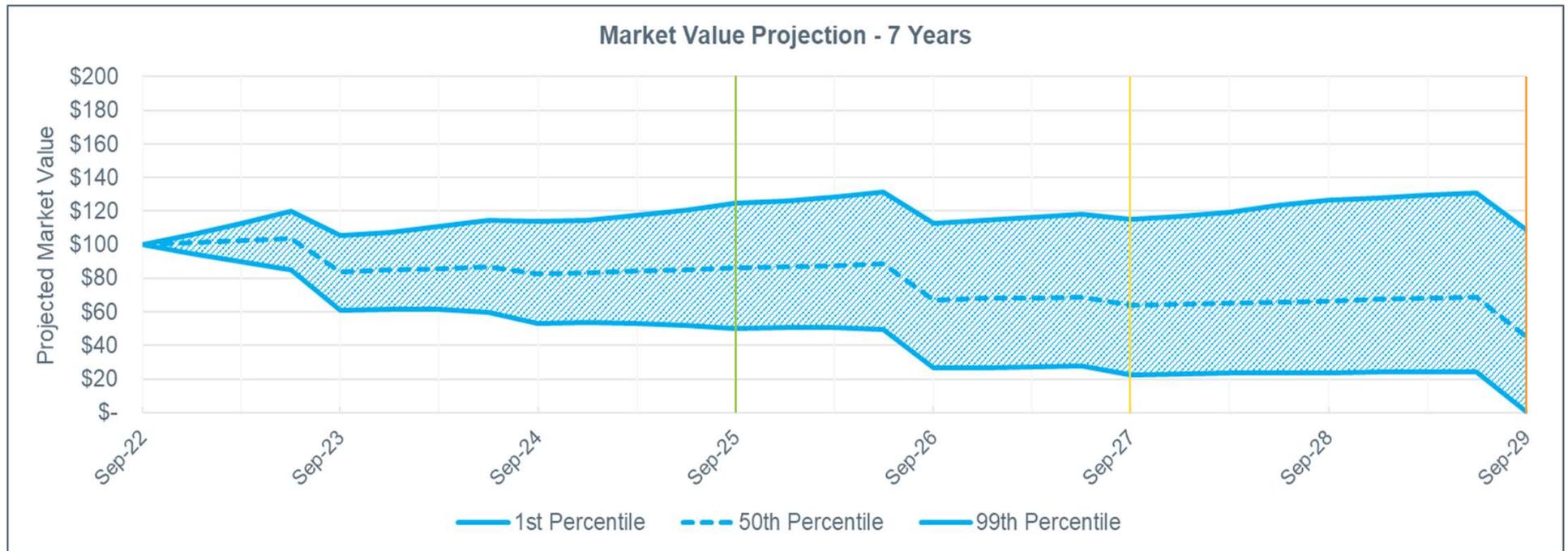
	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	39.16	\$	10.79	Insolvent Sept 2029	
5 <sup>th</sup> percentile return	\$	55.29	\$	26.56	\$	3.33
10 <sup>th</sup> percentile return	\$	62.80	\$	34.91	\$	12.84
25 <sup>th</sup> percentile return	\$	74.39	\$	49.48	\$	28.13
50 <sup>th</sup> percentile return	\$	88.33	\$	66.60	\$	48.78
75 <sup>th</sup> percentile return	\$	101.97	\$	85.79	\$	72.55
90 <sup>th</sup> percentile return	\$	116.01	\$	105.53	\$	97.29
95 <sup>th</sup> percentile return	\$	125.62	\$	117.59	\$	111.93
99 <sup>th</sup> percentile return	\$	142.74	\$	139.59	\$	126.82

# 70/30 - 7X Spending Scenario 2



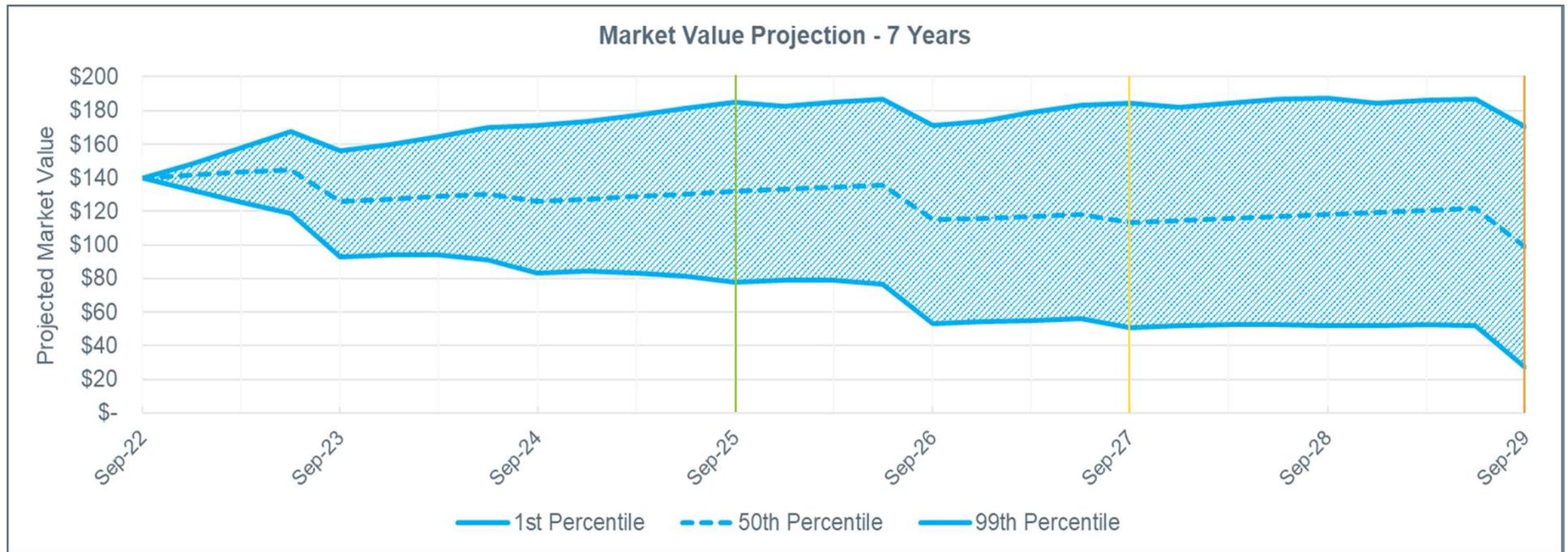
	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	61.48	\$	31.83	\$	10.06
5 <sup>th</sup> percentile return	\$	85.98	\$	56.24	\$	33.37
10 <sup>th</sup> percentile return	\$	97.30	\$	68.96	\$	47.80
25 <sup>th</sup> percentile return	\$	114.50	\$	91.49	\$	71.92
50 <sup>th</sup> percentile return	\$	135.13	\$	117.49	\$	103.92
75 <sup>th</sup> percentile return	\$	155.29	\$	145.16	\$	137.35
90 <sup>th</sup> percentile return	\$	175.26	\$	168.89	\$	161.04
95 <sup>th</sup> percentile return	\$	184.44	\$	181.86	\$	168.45
99 <sup>th</sup> percentile return	\$	191.80	\$	190.83	\$	179.53

# 50/50 - 5X Spending Scenario 2



	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	50.21	\$	22.63	\$	0.62
5 <sup>th</sup> percentile return	\$	61.81	\$	33.96	\$	12.07
10 <sup>th</sup> percentile return	\$	67.45	\$	40.47	\$	18.45
25 <sup>th</sup> percentile return	\$	76.31	\$	51.60	\$	30.36
50 <sup>th</sup> percentile return	\$	86.20	\$	64.02	\$	45.49
75 <sup>th</sup> percentile return	\$	96.10	\$	77.50	\$	61.59
90 <sup>th</sup> percentile return	\$	105.92	\$	90.87	\$	78.68
95 <sup>th</sup> percentile return	\$	112.45	\$	99.52	\$	88.79
99 <sup>th</sup> percentile return	\$	124.52	\$	114.95	\$	109.41

# 50/50 - 7X Spending Scenario 2



	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	78.02	\$	50.92	\$	27.50
5 <sup>th</sup> percentile return	\$	95.60	\$	67.42	\$	46.15
10 <sup>th</sup> percentile return	\$	104.15	\$	77.49	\$	56.84
25 <sup>th</sup> percentile return	\$	117.38	\$	94.49	\$	75.42
50 <sup>th</sup> percentile return	\$	131.92	\$	113.45	\$	98.99
75 <sup>th</sup> percentile return	\$	146.62	\$	133.92	\$	124.16
90 <sup>th</sup> percentile return	\$	160.92	\$	153.56	\$	148.75
95 <sup>th</sup> percentile return	\$	170.65	\$	164.73	\$	159.43
99 <sup>th</sup> percentile return	\$	185.02	\$	184.04	\$	170.35

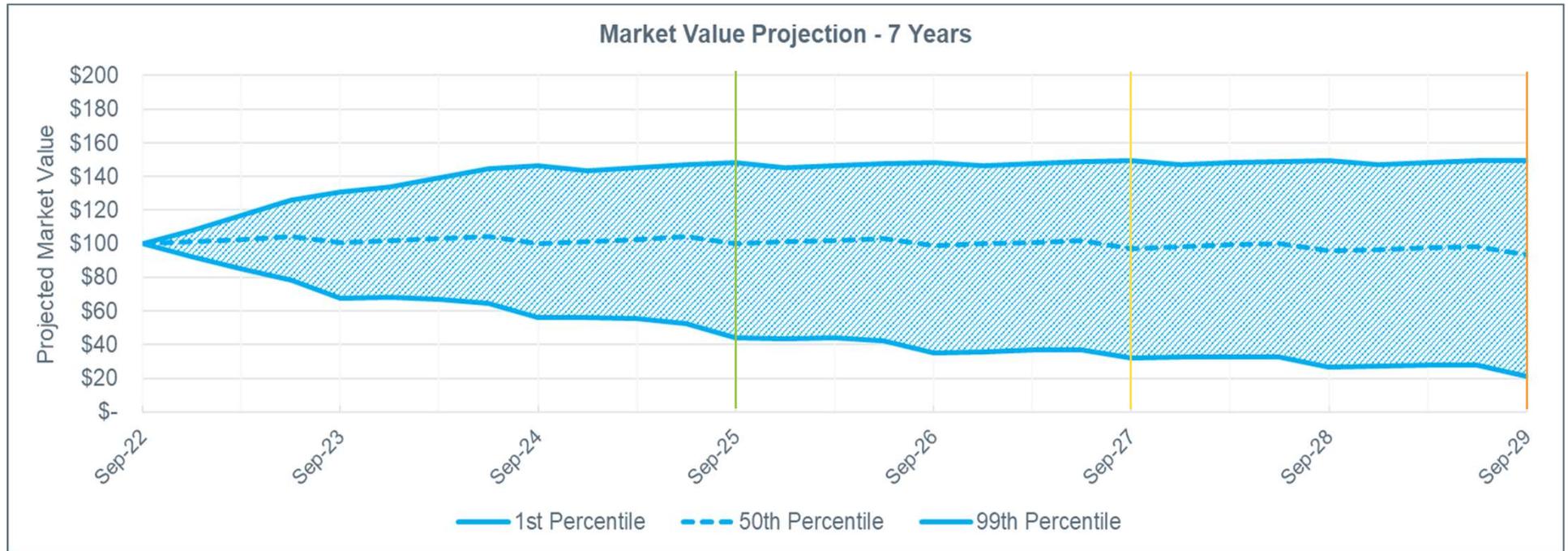
# Scenario 3



# Scenario 3 - Market Values

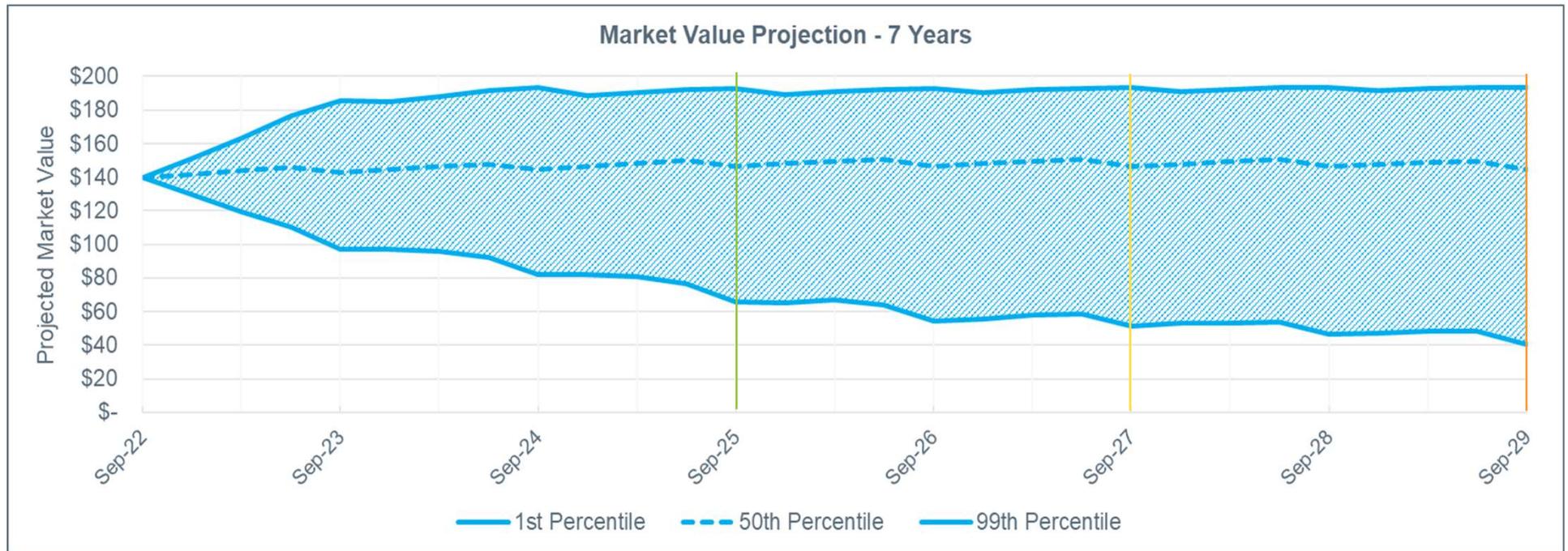
3 Years	5X Spending		7X Spending	
	70/30	50/50	70/30	50/50
1 <sup>st</sup> percentile return	\$ 44.08	\$ 56.49	\$ 66.09	\$ 84.60
5 <sup>th</sup> percentile return	\$ 62.75	\$ 70.03	\$ 93.62	\$ 103.77
10 <sup>th</sup> percentile return	\$ 71.43	\$ 76.48	\$ 105.77	\$ 113.18
25 <sup>th</sup> percentile return	\$ 84.48	\$ 86.70	\$ 124.55	\$ 127.76
50 <sup>th</sup> percentile return	\$ 100.11	\$ 97.68	\$ 146.68	\$ 143.44
75 <sup>th</sup> percentile return	\$ 115.46	\$ 108.88	\$ 167.27	\$ 159.20
90 <sup>th</sup> percentile return	\$ 130.88	\$ 119.89	\$ 183.32	\$ 174.38
95 <sup>th</sup> percentile return	\$ 139.50	\$ 127.21	\$ 187.96	\$ 181.83
99 <sup>th</sup> percentile return	\$ 148.19	\$ 139.43	\$ 192.97	\$ 188.67
<b>5 Years</b>				
1 <sup>st</sup> percentile return	\$ 31.92	\$ 46.36	\$ 51.46	\$ 74.17
5 <sup>th</sup> percentile return	\$ 49.57	\$ 58.65	\$ 78.90	\$ 92.34
10 <sup>th</sup> percentile return	\$ 59.36	\$ 66.01	\$ 93.37	\$ 103.01
25 <sup>th</sup> percentile return	\$ 76.99	\$ 79.27	\$ 118.66	\$ 122.09
50 <sup>th</sup> percentile return	\$ 97.05	\$ 93.93	\$ 146.30	\$ 143.21
75 <sup>th</sup> percentile return	\$ 119.07	\$ 109.78	\$ 172.79	\$ 164.79
90 <sup>th</sup> percentile return	\$ 136.99	\$ 125.04	\$ 185.35	\$ 179.69
95 <sup>th</sup> percentile return	\$ 143.60	\$ 134.13	\$ 188.47	\$ 184.99
99 <sup>th</sup> percentile return	\$ 149.27	\$ 144.73	\$ 193.48	\$ 189.39
<b>7 Years</b>				
1 <sup>st</sup> percentile return	\$ 20.99	\$ 34.41	\$ 40.81	\$ 62.87
5 <sup>th</sup> percentile return	\$ 38.56	\$ 48.95	\$ 67.73	\$ 83.44
10 <sup>th</sup> percentile return	\$ 49.52	\$ 56.93	\$ 83.93	\$ 94.85
25 <sup>th</sup> percentile return	\$ 68.68	\$ 71.53	\$ 111.19	\$ 116.20
50 <sup>th</sup> percentile return	\$ 93.70	\$ 89.75	\$ 144.66	\$ 142.73
75 <sup>th</sup> percentile return	\$ 120.00	\$ 109.71	\$ 173.36	\$ 167.40
90 <sup>th</sup> percentile return	\$ 138.06	\$ 128.41	\$ 185.67	\$ 181.06
95 <sup>th</sup> percentile return	\$ 144.05	\$ 136.88	\$ 188.77	\$ 185.62
99 <sup>th</sup> percentile return	\$ 149.72	\$ 145.56	\$ 193.49	\$ 189.99

# 70/30 - 5X Spending Scenario 3



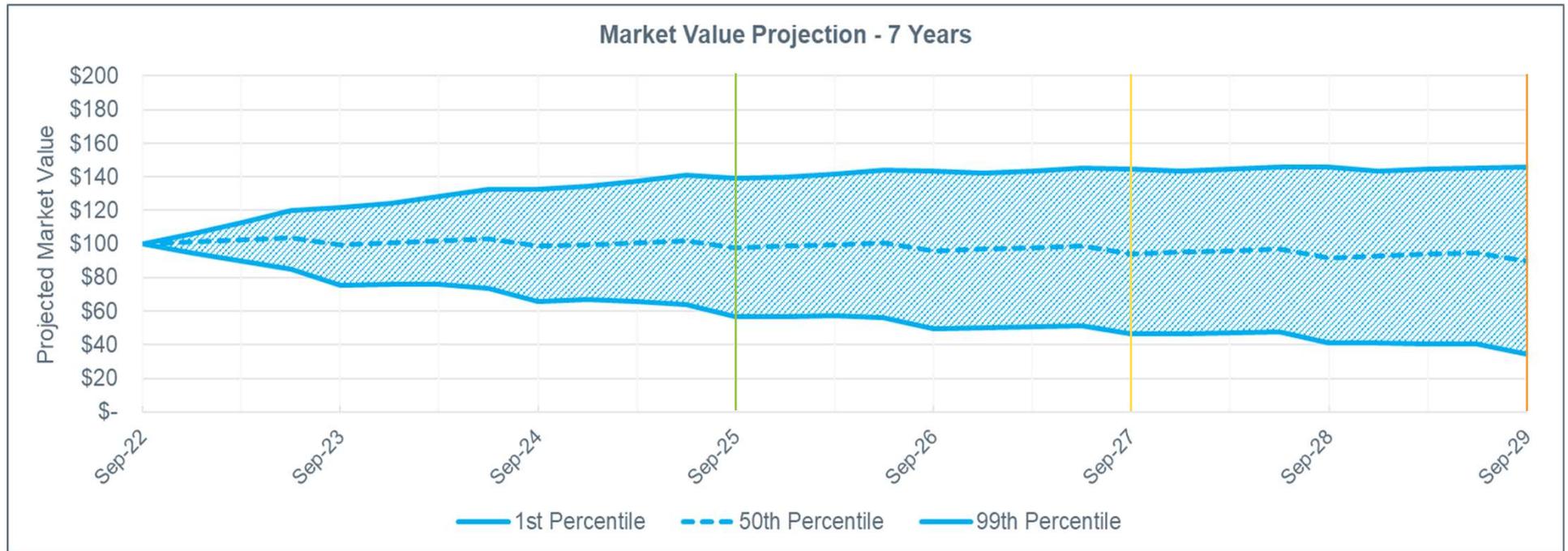
	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	44.08	\$	31.92	\$	20.99
5 <sup>th</sup> percentile return	\$	62.75	\$	49.57	\$	38.56
10 <sup>th</sup> percentile return	\$	71.43	\$	59.36	\$	49.52
25 <sup>th</sup> percentile return	\$	84.48	\$	76.99	\$	68.68
50 <sup>th</sup> percentile return	\$	100.11	\$	97.05	\$	93.70
75 <sup>th</sup> percentile return	\$	115.46	\$	119.07	\$	120.00
90 <sup>th</sup> percentile return	\$	130.88	\$	136.99	\$	138.06
95 <sup>th</sup> percentile return	\$	139.50	\$	143.60	\$	144.05
99 <sup>th</sup> percentile return	\$	148.19	\$	149.27	\$	149.72

# 70/30 - 7X Spending Scenario 3



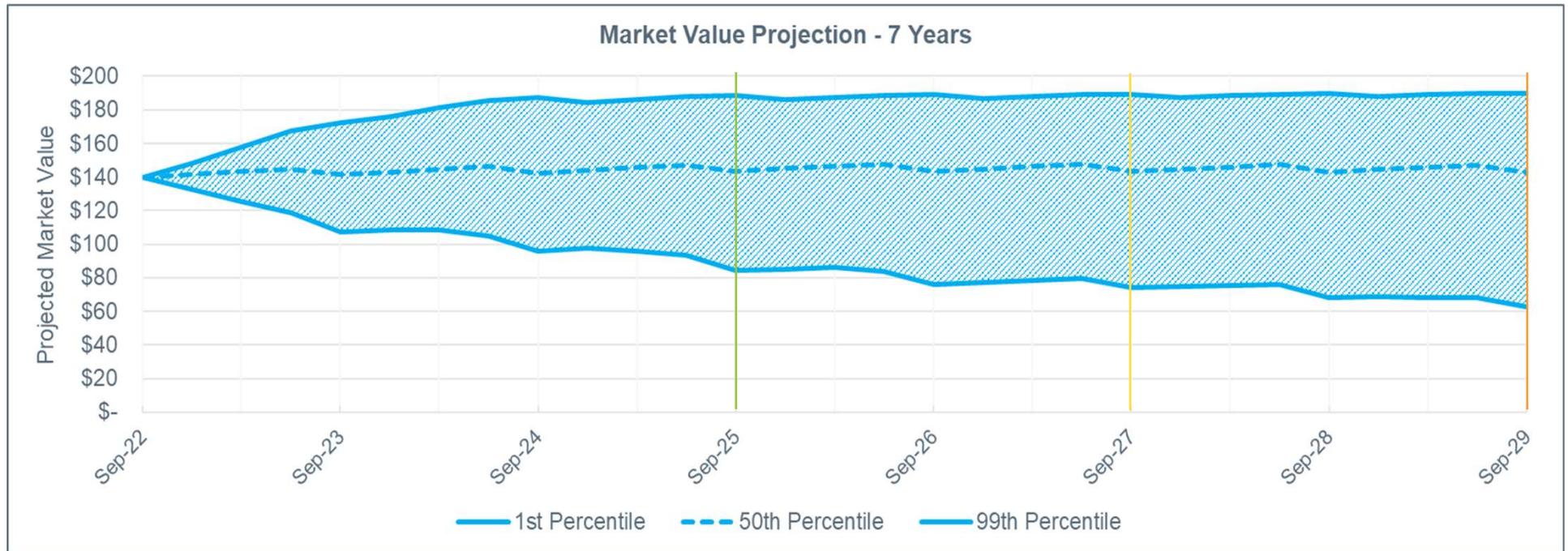
	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	66.09	\$	51.46	\$	40.81
5 <sup>th</sup> percentile return	\$	93.62	\$	78.90	\$	67.73
10 <sup>th</sup> percentile return	\$	105.77	\$	93.37	\$	83.93
25 <sup>th</sup> percentile return	\$	124.55	\$	118.66	\$	111.19
50 <sup>th</sup> percentile return	\$	146.68	\$	146.30	\$	144.66
75 <sup>th</sup> percentile return	\$	167.27	\$	172.79	\$	173.36
90 <sup>th</sup> percentile return	\$	183.32	\$	185.35	\$	185.67
95 <sup>th</sup> percentile return	\$	187.96	\$	188.47	\$	188.77
99 <sup>th</sup> percentile return	\$	192.97	\$	193.48	\$	193.49

# 50/50 - 5X Spending Scenario 3



	3 Years	5 Years	7 Years
1 <sup>st</sup> percentile return	\$ 56.49	\$ 46.36	\$ 34.41
5 <sup>th</sup> percentile return	\$ 70.03	\$ 58.65	\$ 48.95
10 <sup>th</sup> percentile return	\$ 76.48	\$ 66.01	\$ 56.93
25 <sup>th</sup> percentile return	\$ 86.70	\$ 79.27	\$ 71.53
50 <sup>th</sup> percentile return	\$ 97.68	\$ 93.93	\$ 89.75
75 <sup>th</sup> percentile return	\$ 108.88	\$ 109.78	\$ 109.71
90 <sup>th</sup> percentile return	\$ 119.89	\$ 125.04	\$ 128.41
95 <sup>th</sup> percentile return	\$ 127.21	\$ 134.13	\$ 136.88
99 <sup>th</sup> percentile return	\$ 139.43	\$ 144.73	\$ 145.56

# 50/50 - 7X Spending Scenario 3



	3 Years		5 Years		7 Years	
1 <sup>st</sup> percentile return	\$	84.60	\$	74.17	\$	62.87
5 <sup>th</sup> percentile return	\$	103.77	\$	92.34	\$	83.44
10 <sup>th</sup> percentile return	\$	113.18	\$	103.01	\$	94.85
25 <sup>th</sup> percentile return	\$	127.76	\$	122.09	\$	116.20
50 <sup>th</sup> percentile return	\$	143.44	\$	143.21	\$	142.73
75 <sup>th</sup> percentile return	\$	159.20	\$	164.79	\$	167.40
90 <sup>th</sup> percentile return	\$	174.38	\$	179.69	\$	181.06
95 <sup>th</sup> percentile return	\$	181.83	\$	184.99	\$	185.62
99 <sup>th</sup> percentile return	\$	188.67	\$	189.39	\$	189.99

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NEW YORK

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